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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/816,051	03/31/2004	Sundar Vedula	080398.P581	9617

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EXAMINER	
HALLENBECK-HUBER, JEREMIAH CHARLES	
ART UNIT	PAPER NUMBER
2621	
MAIL DATE	DELIVERY MODE
11/12/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/816,051	VEDULA ET AL.	
	Examiner	Art Unit	
	JEREMAIAH C. HUBER	2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 August 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,8-17,19-23 and 25-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8-17,19-23 and 25-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *31 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/26/2009 has been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-6, 12-17, 20-23 and 26-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sohn et al (20030202592) in view of Carlbom (20030033318) and in further view of Guo et al (6353678) and Hamani et al (6765965).

In regard to claims 1 and 2 Sohn discloses a multi-view video encoding method and apparatus that includes:

searching a second frame of a multi-view video sequence for a match of one or more pixels in a first frame of the multi-view sequence (Sohn Fig. 6 and par. 38 note motion and disparity estimation); and

constraining a search range associated with a second frame of the multi-view video sequence to a first defined area, with a defined height (Sohn. par. 52 note motion vector search range is already set, also note disparity vector vertical code flag for predetermined height).

Sohn further discloses altering encoding methods to preserve semantic accuracy (Sohn par. 53), including determining the height of a search range (Sohn par. 52 note vertical limits of disparity search are included in header). It is noted that Sohn does not explicitly disclose that the defined search area is relative to the position of an epipolar line. However, Carlbom discloses a motion estimation method wherein pixels are matched between a first and second frame (Carlbom pars. 91-93); that the search range can be of different sizes (Carlbom pars. 92-93); using epipolar constraints to determine a search in one frame with respect pixels in another frame (Carlbom par. 92); and use of an expected position or initial seed (Carlbom par. 92). It is therefore considered obvious that one of ordinary skill in the art would recognize the advantage of using an epipolar constrained motion estimation method taught by Carlbom to obtain the motion vectors of Sohn in order to have an efficient estimation method as suggested by Carlbom (Carlbom par. 92).

It is further noted that neither Sohn nor Carlbom specifically disclose details pertaining to the computation of an epipolar line. However, the use of epipolar lines,

which depend on camera geometry, in multi-view video processing was common and notoriously well known in the art at the time of the invention as is shown by Guo (Guo col. 8 line 55 to col. 9 line 15). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would recognize the advantage utilizing epipolar lines as taught by Guo in the invention of Sohn in view of Carlbom in order to calculate three dimensional geometries using few correspondence points as suggested by Guo (Guo col. 8 lines 55 to 64).

Sohn further discloses altering encoding methods in light of the expected size of the 'motion' vector (Sohn Fig. 7, 8 and par. 53 note when small disparity vectors are expected, a single view is used as a reference, whereas when larger disparity vectors are expected two views are used as a reference). It is further noted that neither Sohn, Carlbom expressly disclose that constrained search ranges to areas relate to a correlation between efficient compression and semantic accuracy, or use of two such correlations for different frames. However, Hanami discloses an apparatus for detecting motion vectors wherein a large, coarse search range is used when inter-frame distances and hence expected displacements are large, and a small, fine search range is used when inter-frame distances and hence expected displacements are small (Hamani Figs. 24-28 note col. 18 lines 45-62 further note col. 11 lines 8-25 for explanation of coarse and fine search). Further each search range represents a correlation between efficient compression and semantic accuracy, in that the coarse search range preserves semantic accuracy for large search ranges by reducing the accuracy of the motion vector, and hence reducing the compression efficiency

because a less costly match to encode may not be searched at the reduced accuracy. Whereas the fine search range maintains a similar degree of semantic accuracy with a higher degree of motion vector accuracy and hence more efficient compression (Hamani col. 19 lines 51-67 explaining that more accurate vectors are obtained from a finer search). It is therefore considered obvious that one of ordinary skill in the art would recognize the advantage of applying a frame distance dependant search ranges to the disparity and motion vector searches of Sohn in view of Carlbom in order to improve the compression efficiency in Sohn by allowing use of a single reference view even when the expected disparity between views is large.

Further any constrained disparity search inherently represents some desired correlation between efficient coding and semantic accuracy. A less constrained will inherently improve coding efficiency by increasing the number of possible matches and thereby improving compression, whereas constraining a search area relative to an epipole will inherently increase semantic accuracy by restricting the search to an area that accords with camera geometry. Therefore any search area constrained in some way by epipolar considerations will inherently define some correlation between efficient coding and semantic accuracy.

In regard to claim 3 refer to the statements made in claim 1 above Carlbom further teaches that pixels in the first frame represent a region, or block (Carlbom par. 91).

In regard to claim 4 refer to the statements made in claim 2 above Carlbom further teaches computing the epipolar line in the second frame (Carlbom par. 92).

In regard to claims 5 refer to the statements made in the rejection of claim 4 above. Guo further discloses using a fundamental matrix to calculate epipolar lines. (Guo col. 8 line 55 to col. 9 line 15).

In regard to claims 6, 12-17, 20-23 and 26-30 refer to the statements made in claims 1-4 and 6 above.

2. Claims 8-11, 19, 25, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sohn et al (20030202592) in view of Carlbom and in further view of Guo and Hamani and Newman et al (6154600).

In regard to claims 8-11, 19, 25 and 31, Sohn in view of Carlbom and in further view of Guo and Hamani discloses a motion estimation method as stated in the rejection of claims 1, 12, 20 and 26 above. Sohn in view of Carlbom further discloses dynamically updating parameters during operation (Carlbom par. 91). It is noted that neither Sohn nor Carlbom disclose specifics of user input. However Newman discloses a video editing system in which a user can input parameters through a slider in a user interface (Newman col. 14 lines 59-64). It is therefore considered obvious that one of ordinary skill in the art at the time of the invention would recognize the advantage of including user input through a slider window in a user interface as taught by Newman in the invention of Sohn in view of Carlbom in order to allow closer user control over process values such as what value is used to discriminate between long and short inter-frame distances in Hamani.

Response to Arguments

Applicant's arguments with respect to claims 1-31 have been considered but are moot in view of the new ground(s) of rejection.

In response to the applicants arguments made in regard to the inherency statement in claim 1 above, the applicant asserts that the inherency rational is unreasonable because Carlbom is directed towards tracking a ball to generate metadata and not towards compression efficiency or semantic accuracy. The examiner must disagree. As an initial matter, matter Carlbom is directed to at least semantic accuracy, as Carlbom initially allows for conservative search sizes to ensure a match and only narrows the search sizes when accuracy can be maintained within a smaller search range (Carlbom par. 91-93). Further the applicant argues individually against the Carlbom where the rejection is based on Sohn in view of Carlbom, Guo and now Hamani. In this case Sohn is directed to MPEG encoding of multi-view video and is therefore directed to issues of compression efficiency. The examiner notes that Sohn does explicitly disclose details relating to semantic accuracy. However, as stated in the rejection of claim 1 above a correlation between semantic accuracy and efficient compression is inherent in any search area.

Further if either Sohn Carlbom, or Guo explicitly, or implicitly disclosed a correlation between efficient compression and semantic accuracy then the examiner would not need to rely upon inherency. Therefore the applicant's argument that a reference is not directed to either is unpersuasive as no finding of inherency would be possible of disclosure of the inherent element was required.

In regard to future amendments the examiner would recommend further clarifying the correlation between semantic accuracy and efficient compression. The examiner would further suggest amending the claims to indicate disparity estimation, and a disparity vector instead of a motion vector as claimed, because as previously discussed in the interview on Feb. 27, 2009, the specification indicates that the frames are not separated in time but as separate viewpoints. The applicant is entitled to be his own lexicographer, but the examiner believes such an amendment would clarify the claim.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Berestov discloses a method for adjusting epipolar lines in which an initial search is performed with one search range and subsequent searches are performed with another. "Hierarchical Disparity Estimation Using Spatial Correlation" discloses a method for hierarchical disparity estimation in which disparity vectors, with initial seed values are searched over search windows of two different sizes. “Hierarchical Block Matching for Disparity Estimation in Stereo Sequences” discloses a hierarchical disparity estimation method in which search ranges for lower levels is varied depending on the accuracy of the result at higher levels, further the method can be terminated at high levels thus producing a variety of search area sizes. “Exploiting Spatial Variability for Disparity Estimation” discloses a disparity estimation method in which search window sizes are adapted based on the reliability of disparity matches.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JEREMAIAH C. HUBER whose telephone number is (571)272-5248. The examiner can normally be reached on Mon-Fri 8:00 a.m. - 4:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mehrdad Dastouri can be reached on (571)272-7418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeremiah C Huber
Examiner
Art Unit 2621

/Jeremiah C Huber/
Examiner, Art Unit 2621

/Dave Czekaj/

Primary Examiner, Art Unit 2621